

# EM70 Servo Controller Instruction Manual

Thank you for purchasing a Shimaden product.

Please check that the delivered product is the correct item you ordered. Please do not begin operating this product before you read this instruction manual thoroughly and understand its contents.

## Notice

Please ensure that this instruction manual is provided to the final user of the instrument.

## Preface

This instruction manual is meant for those who will be involved in the wiring, installation, operation and routine maintenance of the EM70. It describes matters to be attended to in handling the EM70, how to install it, its wiring, its functions and its operating procedure. Keep this manual at the work site while handling the instrument and follow the guidance provided herein.

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## 1. Safety Rules

For matters regarding safety, potential damage to equipment and/or facilities, additional instructions and notes are indicated by the following headings.

### ⚠ WARNING

This heading indicates hazardous conditions that could cause injury or death of personnel unless extreme caution is exercised.

### ⚠ CAUTION

This heading indicates hazardous conditions that could cause damage to equipment and/or facilities unless extreme caution is exercised.

### NOTE

This heading indicates additional instructions and/or notes.

The mark  $\ominus$  represents a protective conductor terminal. Make sure to ground it properly.

### ⚠ WARNING

The EM70 is designed for controlling the physical quantities of a control motor and/or other general industrial equipment. Avoid using it for control of devices upon which human life is sustained. When used, adequate and effective safety measures must be taken. No warranty is valid in the case of an accident arising from the use of this product without first undertaking such safety measures.

### ⚠ WARNING

- For using this instrument, house it in a control box or the like lest its terminals come into contact with a person.
- Do not draw out the instrument from its case. Do not insert your hand or any conductive body in the case. That action may lead to serious injury or death due to an electric shock.
- Make sure to ground protective conductor terminals.
- During preparatory adjustment and operation of this instrument, operating terminals (dampers, valves, etc.) are put into action in the entire range of their motions. You should ensure safety in their movable ranges before operation.

⚠ CAUTION

To avoid damage to connected equipment, facilities or the EM70 itself due to a fault of the product, safety measures must be taken before usage, such as the installation of a fuse, an overheating protection device or the like. No warranty is valid in the case of an accident arising from the use of this product without such safety measures having been undertaken.

⚠ CAUTION

- The alert mark ⚠ on the plate affixed to the instrument: On the terminal nameplate affixed to the case of this instrument, the alert mark ⚠ is printed. This is to warn you of the risk of electric shock which may result if the terminal is touched while being energized.
- As a means to turn the power off, a switch or a breaker should be installed in the external power circuit to be connected to the power terminal of the instrument. Fix the switch or the breaker adjacently to the instrument in a position which allows it to be operated with ease, with an indication that it is a means of turning the power off. Use a switch or a breaker which meets IEC947 requirements.
- Fuse: Since the instrument does not have a built-in fuse, do not forget to install a fuse in the power circuit to be connected to the power terminal.  
Fuse rating/characteristics: 250 VAC 0.5 A/medium lagged or lagged type.  
Use a fuse which meets IEC127 requirements.
- Voltage/current of a load to be connected to the output terminal and the alarm terminal should be within a rated range. Otherwise, the temperature will rise to reduce the life of the product and/or to result in problems with the product. For rated voltage/current, see 10. Specifications.  
The output terminal should be connected with a device which meets IEC1010 requirements.
- A voltage/current different from that of the input specification should not be applied to the input terminal. It may reduce the life of the product and/or result in problems with the product. For rated voltage/current, see 10. Specifications.  
In the case of voltage or current input, the input terminal should be connected to a device which meets IEC1010 requirements.  
The instrument is provided with a draft hole for heat discharge. Take care to prevent metal and other foreign matter from entering this hole. Failure to do so may result in trouble with the instrument or may even cause a fire.
- Do not block the draft hole or allow dust or the like to stick to it. A rise in temperature or insulation failure may result in a reduction of the life of the product and/or problems with it or may cause a fire.  
For spaces between installed instruments, refer to 3-4. External Dimensions and Panel Cutout.
- It should be noted that repeated tolerance tests against voltage, noise, surge, etc. may lead to deterioration of the instrument.
- Users are prohibited from remodeling the product or abnormal use thereof.

## 2. Introduction

This instrument, connected to a control motor to rotate the motor shaft, is capable of adjusting opening/closing of valves and the like. Event output, analog output and communication functions are included as options.

### 2-1. Check before Use

This product has been fully inspected for quality assurance prior to shipment. Nevertheless, you are requested to make sure that there is no error, damage or shortage of delivered items by checking the

model codes and the external view of the product and the number of accessories.

#### ① Confirmation of Model Codes

Check the model codes affixed to the case of the product to ascertain if the respective codes designate what was specified when you ordered it, referring to the following code table:

Example of model codes:

E	M	7	0	—	4	Y	—	0	0	0	0	
1					2	3		4	5	6	7	8
1. Series		EM70										
2. Input		4: Current 4~20mA, 0~20mA DC 6: Voltage 1~5V, 0~5V, 0~10V DC										
3. Output type		Y: Contact 240V AC 2A S: Combination of SSR and contact 240V AC 2A										
4. Event output		0: Without 1: Contact output										
5. Analog output		0: Without 4: 4~20mA DC										
6. Square root extraction		0: Without 1: Output by square root extraction of input signal										
7. Communication		0: Without 5: RS-485 7: RS-232C										
8. Remarks		0: Without 9: With										

#### ② Accessories

This instruction manual.....1 copy  
The Communication instruction manual.....1 copy  
(when the optional communication function is added)

**Note:** For any problem with the product, shortage of accessories or request for information, please contact our representative.

## 2-2. Handling Instruction

- ① Do not operate the keys on the front panel with a hard or sharply pointed object. Operate the keys only by softly touching them with fingertips.
- ② When cleaning the instrument, wipe it softly with a dry cloth. Never use solvents such as thinner.

## 3. Installation and Wiring

### 3-1. Installation Site (environmental conditions)

⚠ CAUTION

This instrument should not be used in any of the places mentioned below. Selection of these places may result in trouble with the instrument, damage to it or even a fire.

- ① Where flammable gas, corrosive gas, oil mist and particles that can deteriorate electrical insulation are generated or abundant.
- ② Where the temperature is below -10°C or above 50°C.
- ③ Where the relative humidity is above 90% RH or below the dew point.
- ④ Where highly intense vibration or impact is generated or transferred.
- ⑤ Near high voltage power lines or where inductive interference can affect the operation of the instrument.
- ⑥ Where the instrument is exposed to dew drops or direct sunlight.

- ⑦ Where the height is above 2000 m.
- ⑧ Outdoors.

**Note:** The environmental conditions belong to the installation category II of IEC664 and the degree of pollution is II.

### 3-2. Mounting

#### ⚠ CAUTION

For safety's sake and to protect the functionality of the product, do not remove its body from the case. If it needs to be drawn out for replacement or repair, call our sales office in your neighborhood.

- ① Cut a hole for mounting the controller in the panel by referring to the cutout drawing in Section 3-4.
- ② The panel thickness should be 1.0~4.0 mm.
- ③ As the instrument is provided with pawls for fixing, just press it firmly from the front of the panel.
- ④ The EM70 is designed to be mounted on a panel. Never use it without mounting on the panel.

### 3-3. Wiring

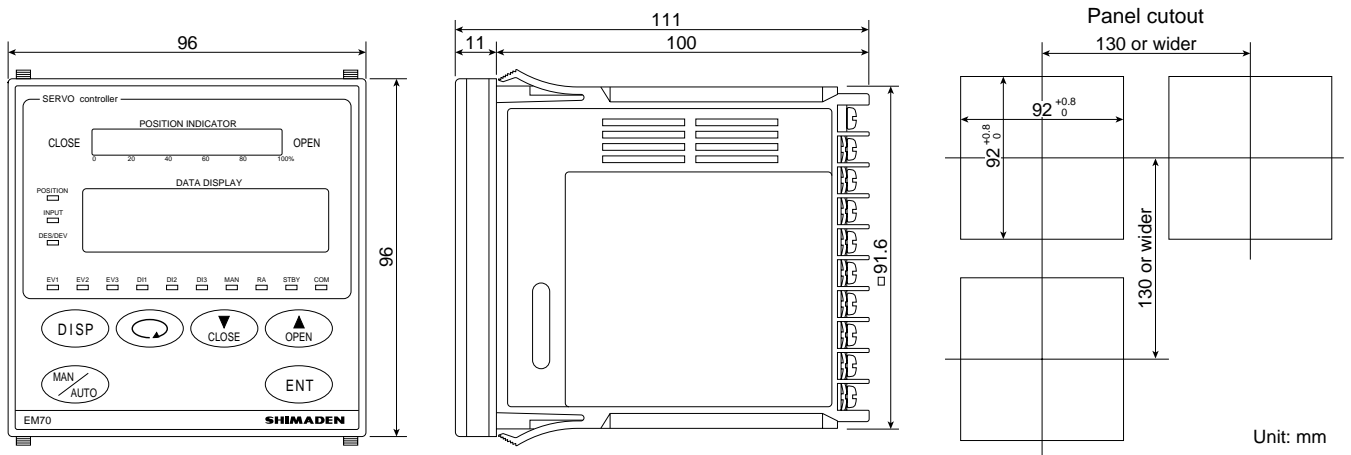
#### ⚠ WARNING

- When wiring, make sure to disconnect the power supply. Otherwise an electric shock may result.
- Make sure to ground the protective conductor terminal (⊕). Otherwise you may receive an electric shock.

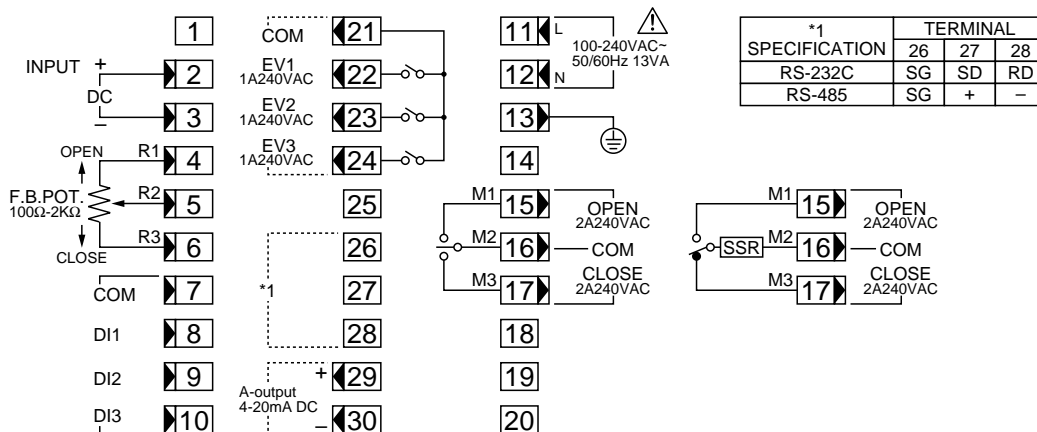
- After wiring, do not touch terminals or other charged elements while it is energized. Otherwise an electric shock may result.

- ① Follow 3-5 Terminal Layout and 3-6 Terminal Arrangement Table and make sure to conduct wiring correctly.
- ② The press-fit terminal must fit an M3.5 screw and have a width of 7 mm or smaller.
- ③ The input signal wire must not be accommodated with a high-voltage power cable in the same wiring conduit or duct.
- ④ Shielded wire (one-point grounding) is effective to avoid electrostatic induction noise.
- ⑤ Twisting the input wires at short and equal intervals is an effective way to avoid magnetic induction noise.
- ⑥ For wiring for power supply, use a 600V vinyl insulated wire or cable which is 1 mm<sup>2</sup> or larger in section or a wire or cable of equivalent for higher performance.
- ⑦ The wire for grounding must be 2 mm<sup>2</sup> or larger in section and must be grounded at a grounding resistance of 100Ω or lower.
- ⑧ Clamp the terminal screws firmly.  
Clamp receiving torque: 1.0N·m (10 kgf·cm)

### 3-4. External Dimensions and Panel Cutout



### 3-5. Terminal Layout

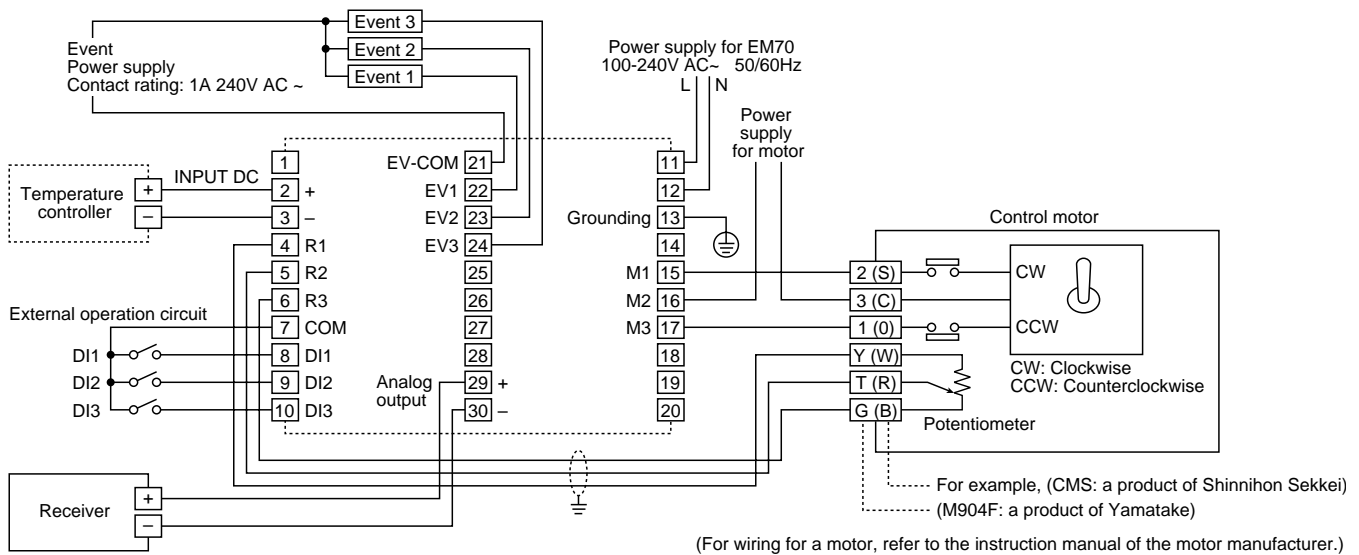


### 3-6. Terminal Arrangement Table

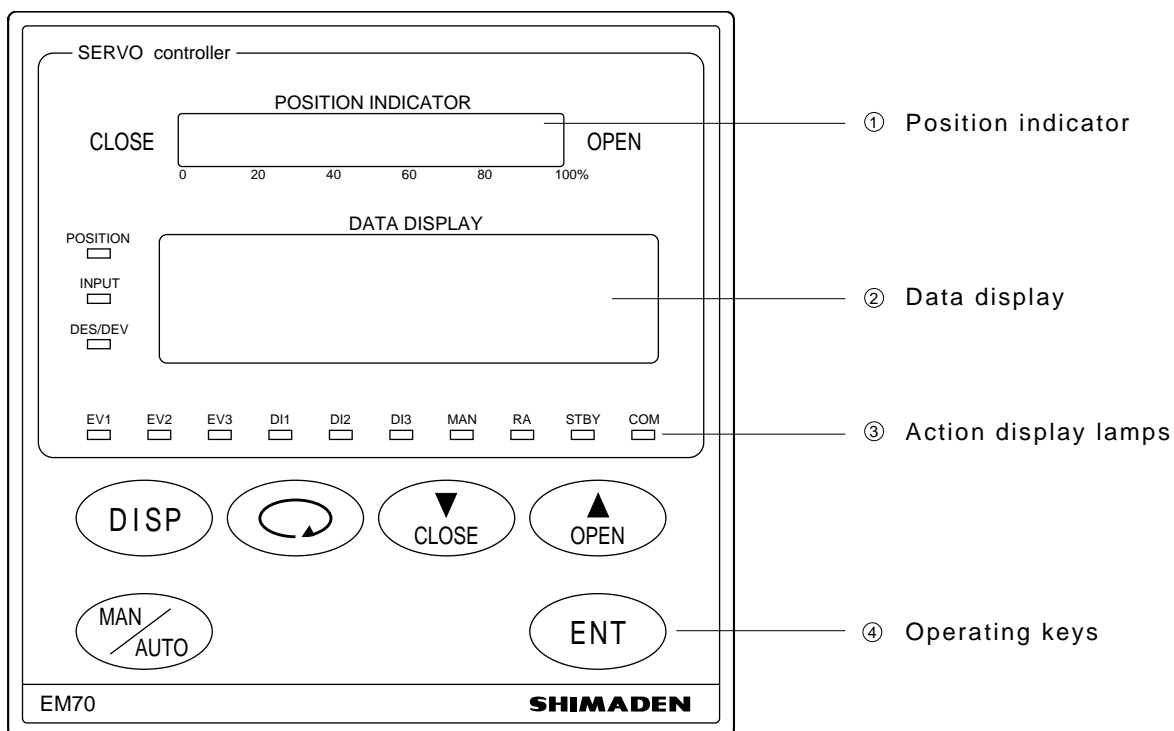
Name of terminal	Description and Code	No.	Name of terminal	Description and Code	No.	
Power supply	100-240V AC±10% L	11	Event output (option)	Contact COM	21	
	50/60Hz 13VA N	12		Contact EV1	22	
Protective conductor	Protective grounding	13		Contact EV2	23	
		14		Contact EV3	24	
Input	Voltage/Current +	2	Communication (option)	RS-232C: SG	RS-485: SG	26
	-	3		SD	+	27
Output	Contact as well as SSR	M1 OPEN		RD	-	28
		M2 COM	15	Analog output (option)	+	29
		M3 CLOSE	16		-	30
Potentiometer input	OPEN	R1	4	External operation input	COM	7
	F.B.POT	R2	5		DI1	8
	CLOSE	R3	6		DI2	9
External operation input		COM	7	DI3	10	
		DI1	8			
		DI2	9			
		DI3	10			










### 3-7. Wiring Example

An example of wiring is shown. Particular attention should be paid to common lines and polarity.



### 4. Names and Functions of Parts on Front Panel



Name	Function
① Position display (green)	The present position is shown by a percentage (0 to100%) of opening in the form of bar graph. The bar graph displays 20 dot (dissolubility of 5%). Lights when position value goes above 2.5%, lights full when above 97.5%. Turns off when below 2% with 0.5% of hysteresis.
② Data display (green)	<p>(1) Position (degree of opening) is displayed usually but display changes every pressing of the  key from INPUT to DES (set value of position) and to DEV (deviation). (Position, input, target degree of position and deviation displays)</p> <p>(2) Set value and item are displayed on each parameter screen.</p>
③ Action display lamps	<p>(1) POSITION (green) lights when display of present position is selected.</p> <p>(2) INPUT (green) lights when input display is selected.</p> <p>(3) DES/DEV (green) lights when set value of position or deviation obtained by deducting set value of degree of opening from present degree of opening is selected.</p> <p>(4) EV1 (orange) lights when Event 1 is in action.</p> <p>(5) EV2 (orange) lights when Event 2 is in action.</p> <p>(6) EV3 (orange) lights when Event 3 is in action.</p> <p>(7) DI1 (green) lights when external input (DI1) is ON.</p> <p>(8) DI2 (green) lights when external input (DI2) is ON.</p> <p>(9) DI3 (green) lights when external input (DI3) is ON.</p> <p>(10) MAN (green) flashes during manual operation and remains off during automatic operation.</p> <p>(11) RA (green) lights during reverse action (RA) and remains off during direct action (DA).</p> <p>(12) STBY (green) lights when suspension of action (stand-by) is selected in operation/suspension switching. It remains off during ordinary operation.</p> <p>(13) COM (green) lights when COM (reading/writing) is selected for communication and goes out when LOC is selected.</p> <p>(14) OPEN (green) lights when control motor is in action toward the open side.</p> <p>(15) CLOSE (green) lights when control motor is in action toward the close side.</p>
④ Operating keys	<p>(1)  (display) key</p> <p>① While the EM70 is in ordinary operation, this key is used to change the display. Each pressing of it changes the display in the following order: Position value → input value → target position value → deviation value → position value.</p> <p>② When this key is pressed on a parameter screen of the screen group 0, the "0-0 basic screen" returns and in screen group 1, "the 1-0 or 1-00 zero/span adjustment screen" returns. Pressing it on the "1-0 or 1-00 zero span adjustment screen"*1 calls "the 0-0 basic screen" of the screen group 0.</p> <p>*1 : When either "the 1-0 or 1-00 zero/span adjustment screen" has been selected, pressing DISP key on any of the parameters screens of the screen group 1 calls the selected screen. (The initial value is the 1-0 screen.)</p> <p>(2)  (parameter) key</p> <p>① Used to proceed from a parameter setting screen to the next parameter setting screen.</p> <p>② By pressing this key continuously for 3 seconds on "the 0-0 basic screen," you can proceed to "1-0 or 1-00 zero/span adjustment screen."</p> <p>(3)  (down) key</p> <p>① Used to decrease a numerical value on a numerical value setting screen.</p> <p>② Used to select an item on a screen for selection.</p> <p>③ In manual operation, this key is used to direct the motor being operated manually toward the close side.</p> <p>(4)  (up) key</p> <p>① Used to increase a numerical value on a numerical value setting screen.</p> <p>② Used to select an item on a screen for selection.</p> <p>③ In manual operation, this key is used to direct the motor being operated manually toward the open side.</p> <p>(5)  (entry/registration) key</p> <p>① On each parameter screen, a value set or an item selected by means of the  or  key is registered by pressing this key.</p> <p>② When this key is pressed for 3 seconds continuously on "the 1-0 or 1-00 zero/span adjustment screen," you can proceed to next screen.</p> <p>(6)  (manual/automatic) key</p> <p>① Pressing this key on "the 0-0 basic screen" continuously for 2 seconds changes automatic operation to manual operation.</p> <p>② Pressing this key during manual operation continuously for 2 seconds releases manual operation and the instrument is returned to automatic operation.</p> <p>③ By pressing this key on a setting screen of the screen group 1, you can go back to the screen preceding it.</p>

## 5. Before Starting Up

In the following, those matters requiring your attention before starting operation are described. For the operating procedure and setting, refer to 6. Explanation of Screens and Parameter Setting.

### 5-1. Procedure of Adjustment for Trial Run

① Checking of wiring:

Check that the wiring to connected terminals is carried out properly. Particular attention should be paid to the power line since erroneous wiring of, for example, the control input terminal to a weak current line will result in burnout. If the control motor is not connected, it is regarded as a position error.

② Application of operating power:

Apply operating power. The EM70 is energized and the data display and other lamps turn ON.

③ Data input:

In case such control items as external operation, event output and position setting upon occurrence of an error are used, input necessary data on each screen. Jot down necessary data in 9. Parameter Setting Record and input them.

④ Confirmation of contents of input:

Double-check that your inputs are correct.

⑤ Confirmation of the direction of revolution, full open position and full close position by manual operation:

Confirm by manual operation that the direction of revolution (direction of opening and direction of closing) of the control motor is correct. Inverse setting of the direction

of revolution involves danger. Correct the wiring if that is the case with reference to "Cause of Trouble and Troubleshooting." You should also confirm the positions of the control motor in the fully closed condition (0%) and the fully opened condition (100%). If out of position, select "zero/span adjustment" manually or automatically and correct it.

⑥ Release manual operation and start automatic operation for a trial run.

### 5-2. Priority Order of Control Actions

① Control is carried out usually by input signals from a controller but external input by external operation and manual operation are given priority over it.

② In consideration of an emergency safety-threatening situation, manual operation is given top priority.

③ External input through external operation takes precedence to automatic operation by the controller, that is, it can interrupt the latter. Among external inputs, priority is given to the DI1, DI2 and DI3 in the order mentioned.

### 5-3. Notes on Initialization following Data Change

① Upon changing a selected event type:

If registered already, the setting for the event is totally initialized (all parameters return to initial values). You have to set them again.

② Upon changing selected analog output (input signal from controller or position):

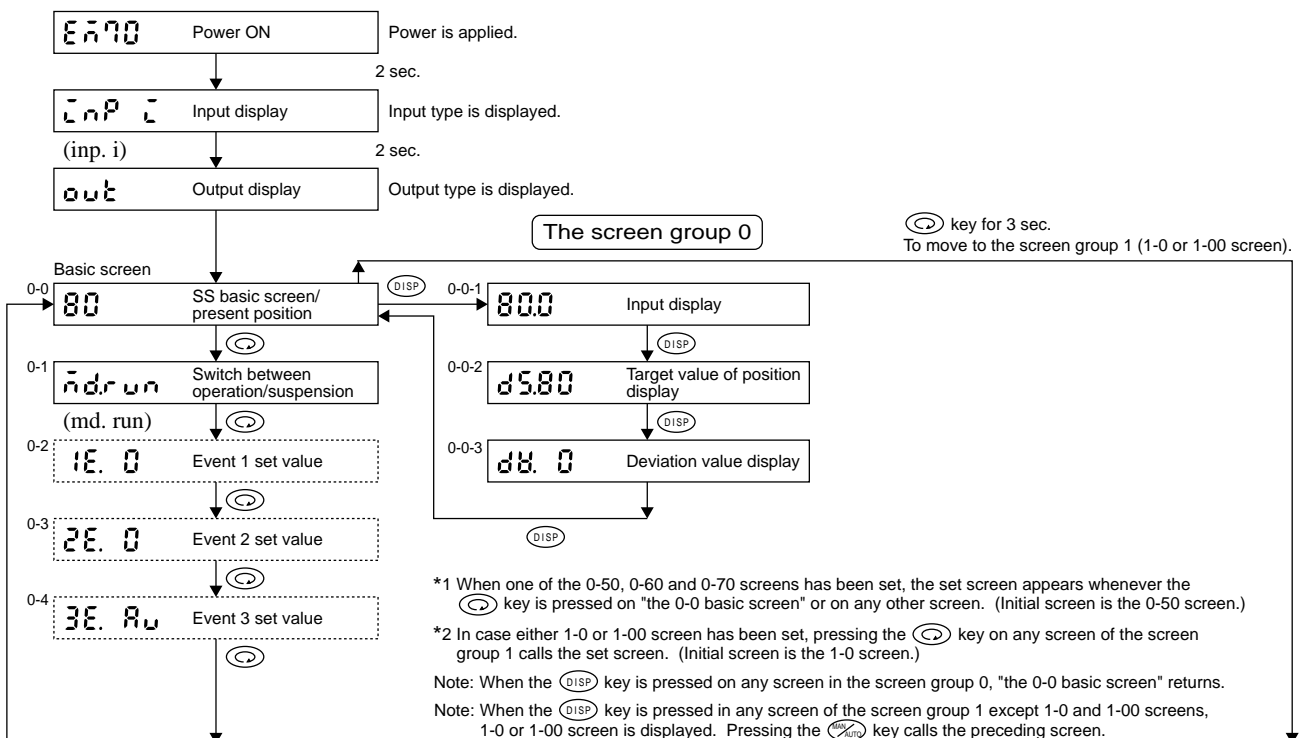
If registered already, higher limit and lower limit value of the selected item will be initialized. You should reset them.

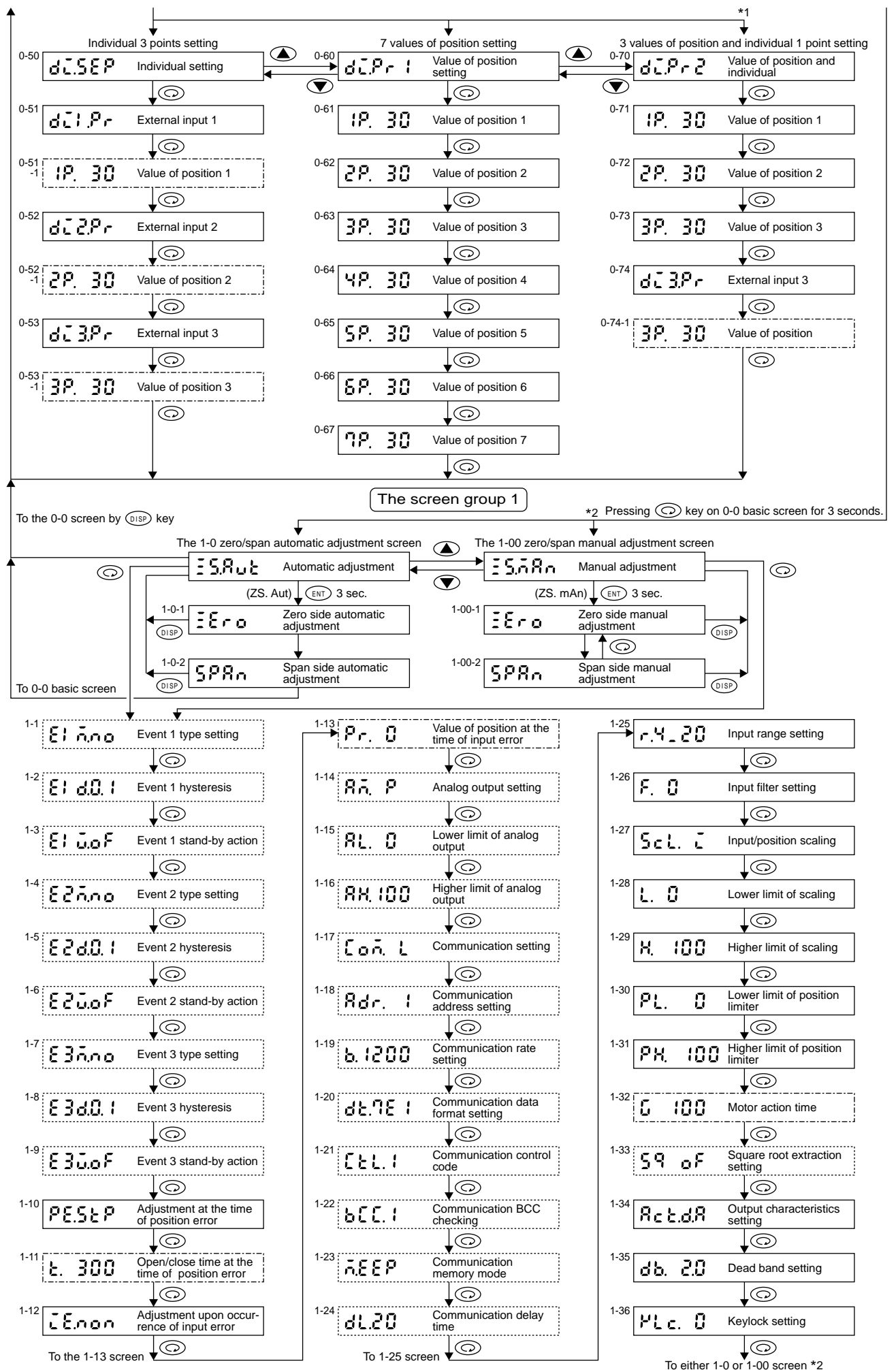
## 6. Explanation of Screens and Parameter Setting

### 6-1. Parameter Flow

**Note:** Three kinds of frame lines signify the following. The number on the left side of the frame indicates the screen number.

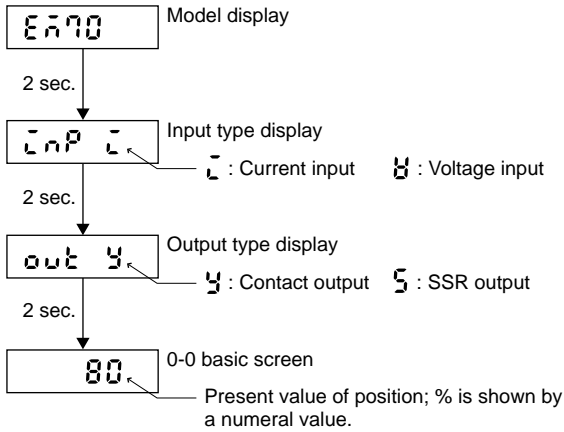
- Screens regularly shown by key operation and other means.
- Screens shown when appropriate options are added or selected.
- Screens shown only when selected in control action modes.





## 6-2. Display upon Power-ON

When power is applied, initial screens upon power-ON are displayed successively, each for about 2 seconds to allow you to see the types of input and output of this instrument. Then, in about 2 seconds, the basic screen is displayed. From this screen, the display proceeds to screens for setting various functions by means of operating keys. For the order of screens to appear, refer to 6-1 Parameter Flow.



Note 1: The "◦" mark after a numerical value or a character on each screen means flashing, that is, the setting is not registered even when the screen changes. To register it, press the (ENT) key, and "◦" disappears.

Note 2: If no key is operated for more than 3 minutes upon turning power ON, the display will return to the 0-0 screen even when a setting has been registered. The registration remains valid despite the return to the 0-0 screen.

### Definition of Terms

**Position** : It means the rate of opening between the fully closed condition (0%) and the fully opened condition (100%) of control motor.

**Binary** : While decimal numerals express quantity and classification of items with the combination from 0-9, the binary numeral used in the digital field expresses the quantity, classification and the amount only with the combination of 0 and 1 (ON or OFF)

**Target position setting** : Preset

**External input** : DI

**OPEN** : Opened

**CLOSE** : Closed

## 6-3. Explanation of Screen Group 0 and Parameter Setting

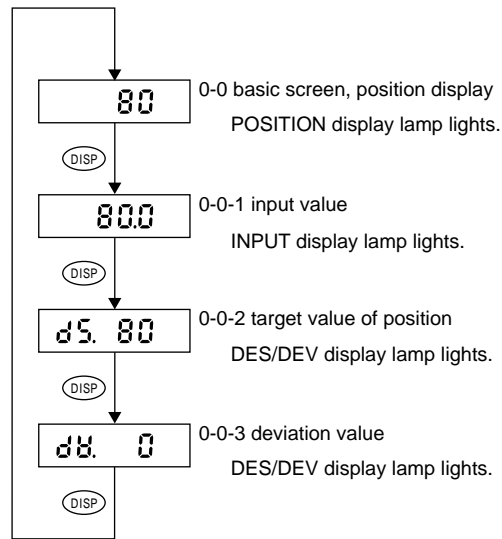
### Method of key operation

The (◁) key is used to proceed to the next screen, the (▲) and (▼) keys for selection on each setting screen and the (ENT) key for registration. (For a change of data display, see the following section.)

On any of the screens in this screen group, except the ones described in (1) Changing Data Display, pressing the (DISP) key calls back the 0-0 basic screen.

### (1) Changing Data Display

Pressing the (DISP) key on the 0-0 basic screen changes various display values.



### ① Display of opening:

The 0-0 basic screen shows the present value of position.

### ② Display of input value:

The 0-0-1 input value screen shows the value of current input or the value of voltage input in % to the range of inputs.

### ③ Display of target value of position:

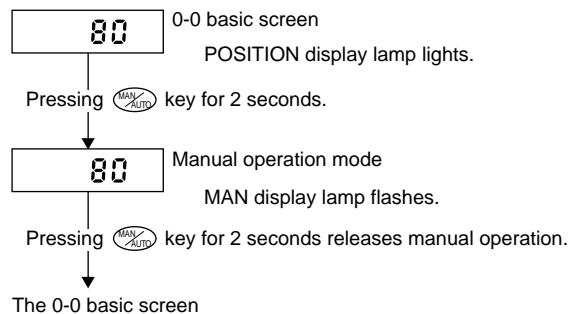
The 0-0-2 target value of degree screen shows a target value of position after each processing. In case an externally input value of position is valid, however, the value of position is shown as a target value of position. When higher and lower position limiters have been set (See the screen group 1), this is limited by the value of a limiter.

### ④ Display of deviation value:

The 0-0-3 deviation value screen shows a value obtained by deducting a target value of position from the present value of position. (Deviation value = Value of position – target value of position) Even when a deviation value exceeds –99%, –99% is shown because of the limitation of the display frame.

## (2) Manual Operation

Manual operation (switching to and releasing manual operation, opening by the (▲) key and closing by the (▼) key) is carried out on the 0-0 basic screen.



### ① Change from automatic operation to manual operation:

Automatic operation is changed to manual operation when (MAN/AUTO) key is pressed for 2 seconds continuously on the basic screen. The MAN display lamp flashes. (Manual operation mode)

### ② Display of position:

When the (▲) key is pressed in the manual operation mode, the position is directed to the opening side and the OPEN display lamp lights; pressing the (▼) key directs it to the closing side and the CLOSE display lamp lights. In



either case, the motor can be operated manually. Keep watching the position indicator and release the  $\blacktriangle$  or  $\blacktriangledown$  key when the target value of the position is reached. Then, the target value remains on the display.

③ Releasing the manual mode:

When you keep pressing the  $\text{MAN/AUTO}$  key for 2 seconds, the manual operation is released, the MAN display lamp goes out and the instrument is put in automatic operation.

④ Priority order of manual operation:

The manual operation is given top priority (over operation, suspension, position setting by external input at the time of position error or input error, the communication mode and so on).

⑤ Continuous operation:

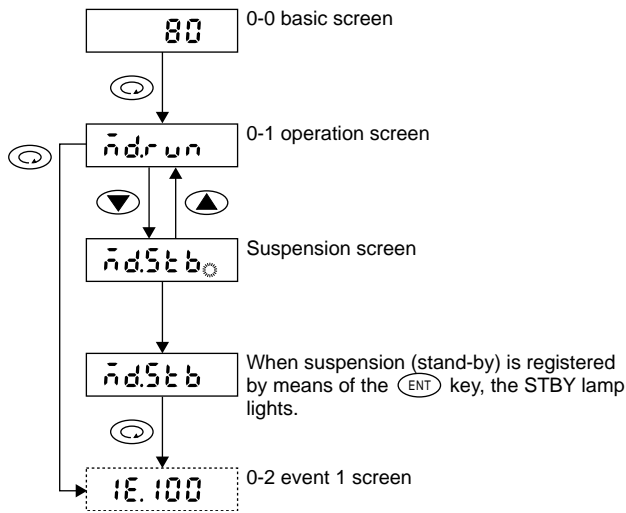
In case control output is SSR output, the motor continues operating (without inching) even when the motor rate is set at 100% or lower.

**Note:** During manual operation, system data should be constantly monitored. Particular attention is required if one leaves the site while the instrument is in manual operation.

(3) Switch between Operation and Suspension

A change from operation to suspension and vice versa is carried out. (0-1 operation screen  $\text{run}$ : Operation (initial value),  $\text{Stb}$ : Suspension)

When the  $\text{ENT}$  key is pressed on the basic screen, you proceed to the operation screen. The initial value is run (operation). When no change is made (the decimal point of the rightmost digit remaining off), press the  $\text{ENT}$  key, and the next screen appears.



① Change from Operation to Suspension:

When the  $\blacktriangledown$  key is pressed on the 0-1 operation screen, the suspension screen is displayed as shown above. Press the  $\text{ENT}$  key to register, and the decimal point flashes. When suspension is selected and registered, the STBY display lamp lights.

② Return from Suspension to Operation:

When the  $\blacktriangle$  key is pressed on the suspension screen, it returns to operation. On any screen, the decimal point of the rightmost digit flashes and registration by pressing the  $\text{ENT}$  stops its flashing. Then, the STBY display lamp goes out.

③ Switching not possible:

When Stand-by ( $\text{Stb}$ ) has been selected on one of the external input 1, external input 2 and external input 3 screen in the individual 3 points setting, it is not possible to change operation or suspension. Then, the operation screen is usable for monitoring only.

Stand-by: In the case of a trial run, maintenance or emergency, operation can be suspended (standing-by or awaiting action). Then, the STBY display lamp (green) on the front panel lights and control output stops.

(4) Setting of Event Set Value (option)

(0-2 event 1 set value setting screen  $1E$ , 0-3 event set value setting screen  $2E$ , 0-4 event 3 set value setting screen  $3E$ . Initial value is  $\text{no}$  and setting range is 0~100% for each of them.)

In case the optional event output (3 points) function is added, it is possible to select different events and contact outputs are produced from the 3 points of EV1, EV2 and EV3.

① Procedure of Setting Set Value of Event:

Before setting a value, an event type should be selected. Set an event type as described in ② Setting of Event Type. (If you change an event type, the set value of the event is initialized and so it should be set again.) Select types of event from the following table.

Event code	Event type	Setting range of event set values	Initial value of event set value
$\text{no}$	None	—	—
$\text{LP}$	Position lower limit absolute value of position	0~100%	0%
$\text{HP}$	Position higher limit absolute value	0~100%	100%
$\text{LC}$	Input lower limit absolute value	0~100%	0%
$\text{HC}$	Input higher limit absolute value	0~100%	100%
$\text{Ru}$	Operation	EV output is continued in the operation mode.	
$\text{RA}$	Manual	EV output is continued in the manual mode.	
$\text{PE}$	Position error	EV output is continued when a position error occurred.	
$\text{IE}$	Input error	EV output is continued when an input error occurred.	
$\text{LE}$	Control loop trouble	If the motor does not operate for a long time (about 30 seconds or longer) despite output of open/close action signals from the EM70 to the motor, it is regarded as control trouble and EV output is continued. (Terminals 22, 23 and 24)	

② Setting of Event Type:

The event 1, event 2 and event 3 type setting screens are called in (3) Setting of Event in the screen group 1 and event types are selected by means of  $\blacktriangle$  and  $\blacktriangledown$  keys. Then register the types by pressing  $\text{ENT}$  key.

There are 4 types of events allowing event set values to be set, i.e., higher and lower limits of position and higher and lower limits of input as shown below:

Setting is possible when 4 types of alarms;  $\text{LP}$ : Lower limit of position,  $\text{HP}$ : Higher limit of position,  $\text{LC}$ : Lower limit of input,  $\text{HC}$ : Higher limit of input; have been set.

( $\text{no}$ : No setting,  $\text{Ru}$ : Operation,  $\text{RA}$ : Manual,  $\text{PE}$ : Position error,  $\text{IE}$ : Input error and,  $\text{LE}$ : Loop trouble are display of screen only.)

Events are used as alarms and sequence signals. As the purposes of uses have been decided on and the event setting screens of the screen group 1 are to be described later. However, set values are set here only when events are set as alarms (the above-stated 4 types) (when the last 3 digits are numerical values). The EV1, EV2 and EV3 display lamps light respectively when events are put in action.

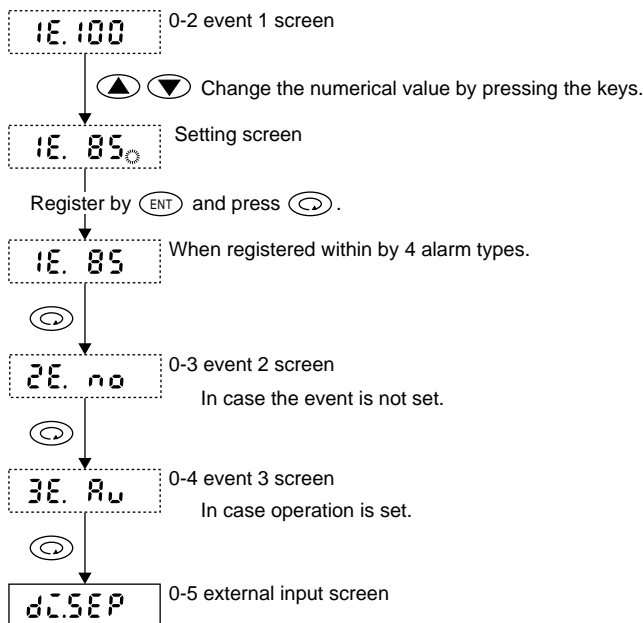
### ③ Setting of Event Set Value:

The setting ranges are from 0 to 100% for all of them. Initial values are 0% on the lower limit side and 100% on the higher limit side.

When the  $\blacktriangle$  or  $\blacktriangledown$  key is pressed on the 0-2 event 1 screen, the decimal point of the rightmost digit on the screen flashes to indicate the shift to the setting screen. At this point, a numerical value is changed by using the  $\blacktriangle$  or  $\blacktriangledown$  key. Once an intended numerical value is reached, the  $\text{ENT}$  key is pressed to register it. The decimal point stops flashing.

Upon finishing the setting, press the  $\text{ENT}$  key to proceed to the next, event 2 screen.

Setting on the event 2 screen and the event 3 is carried out in the same way as on the event 1 screen. In the screens shown below as an example, event 1 is set from the 4 types of alarms, event 2 is not set and operation is set for event 3.



If no change is made on the event 1 screen (the decimal point of the rightmost digit does not light), just press the  $\text{ENT}$  key. The event 2 screen is displayed. When the  $\text{ENT}$  key is pressed on the event 3 screen, the display proceed to the next, external output screen.

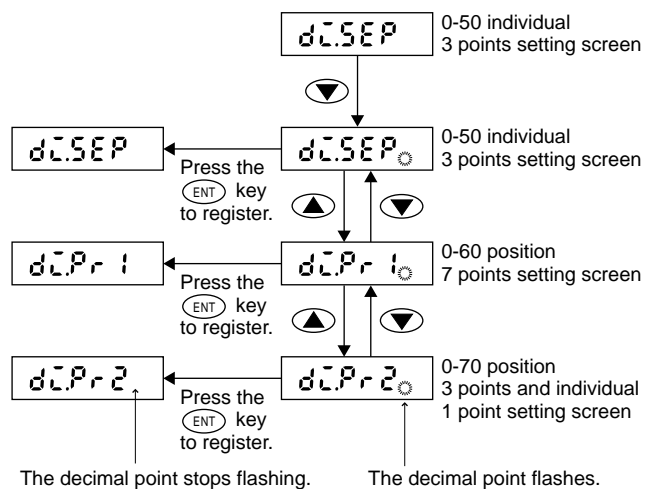
### (5) Switching among 3 Types of External Control Inputs (DI)

External input can break in by no-voltage contact or an open collector signal while the instrument is in operation and operate it.

There are 3 types of external input; individual 3 points setting, degree of opening 7 points setting and individual 1 point setting; and one of them is to be selected. (Initial value: the 0-50 screen)

#### ① Switching among 3 Types

When the  $\blacktriangledown$  key is pressed on the 0-50 individual 3 points setting screen, the decimal point of the rightmost digit on the screen flashes to indicate that it has shifted to the individual 3 points setting screen. When the  $\blacktriangle$  key is pressed there, the display proceeds to the 0-60 position 7 points setting screen and the decimal point of the rightmost digit flashes. Pressing the  $\blacktriangle$  key again, the 0-70 position 3 points and individual 1 point setting screen is displayed and the decimal point of the rightmost digit flashes. To return to the preceding screen, press the  $\blacktriangledown$  key. Pressing the  $\text{ENT}$  key on a screen intended to be selected registers the screen and the decimal point stops flashing.



#### ② Effective time of external input action:

It takes longer than 0.2 seconds from the external input contact ON to the time at which external output action becomes valid.

#### ③ Priority order of external input action in case settings coincide:

Priority is given to external input 1, followed by external input 2 and external input 3.

#### ④ Retention of External Input Action:

Once  $rR$  and/or  $5t$  have been selected, actions by means of external input are retained even after released.

### (6) Setting of Individual 3 Points External Input

(0-50 individual setting screen dLSEP, 0-51 external input 1 setting value dLPr1, 0-52 external input 2 setting screen dLPr2 and 0-53 external input 3 setting screen dLPr3. Initial value is no for each of them. The setting range of vales of position (preset) is from 0 to 100% and initial value is 0%.)

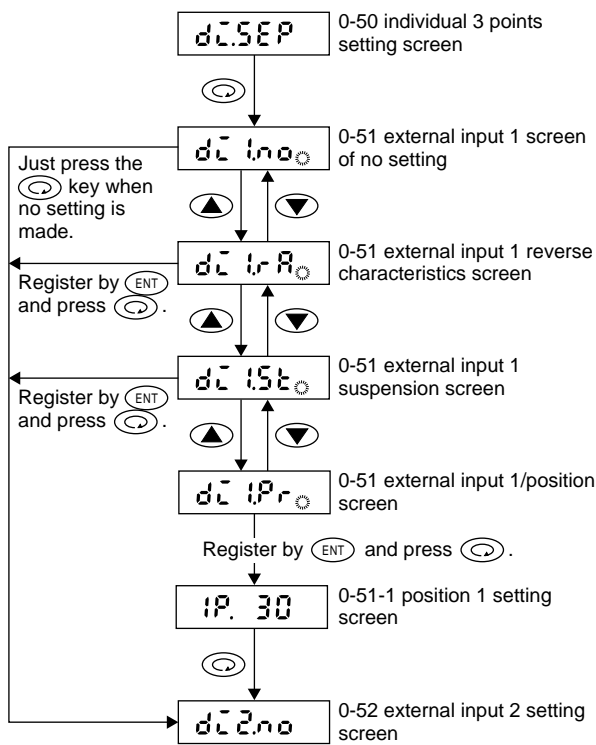
To begin with, on the individual setting screen dLSEP, the screen is registered by means of the  $\text{ENT}$  key.

Selection is possible from 3 items, i.e., switching of output characteristics, Operation/Suspension (stand-by action) and value of position. (The case of no setting is omitted).

#### ① Setting of Input:

Select from the following 4 action types and set for external input 1, external input 2 and external input 3 respectively:  
 $no$ : No setting (initial value),  $rR$ : Reverse characteristics,  $5t$ : Suspension (stand-by),  $Pr$ : Value of position (preset)

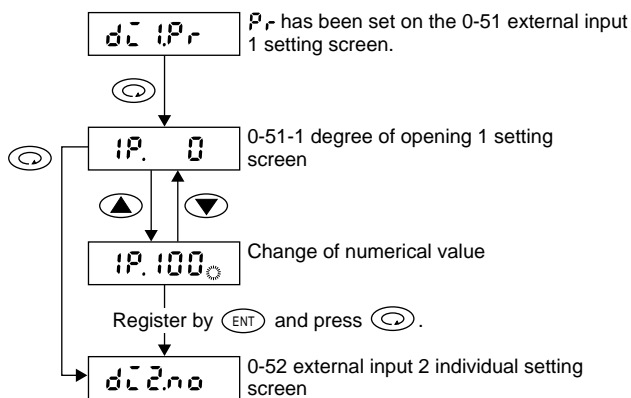
When the  $\text{ENT}$  key is pressed on the 0-50 individual 3 points setting screen, the 0-51 external input 1 setting screen appears. On this screen, selection from the above 4 types of actions is made by means of the  $\blacktriangle$  and  $\blacktriangledown$  keys and the selected action is registered by pressing the  $\text{ENT}$  key. The decimal point stops flashing. By pressing the  $\text{ENT}$  key after the registration, you proceed to the next 0-52 screen. Select action types for external input 2 and external input 3 in the same way as described above.



In the case of no change (the decimal point of the rightmost digit does not flash), just press the  $\odot$  key, and the screen will proceed to 0-52 screen. Nevertheless, only when value of position ( $P_r$ ) has been selected on an external input screen 3, the value of position setting screen will return to 0-0 by pressing the  $\odot$  key.

② Setting on the Value of Position Setting Screen

The setting range of value of position (preset) is between 0 and 100% and the initial value is 0%. When the  $\blacktriangle$  or  $\blacktriangledown$  key is pressed on the 0-51-1 value of position 1 setting screen, the decimal point of the rightmost digit on the screen flashes to indicate that setting is possible. Press the  $\blacktriangle$  or  $\blacktriangledown$  key to change a numerical value. Once an intended value is reached, press the  $\text{ENT}$  key to register it. The decimal point stops flashing.

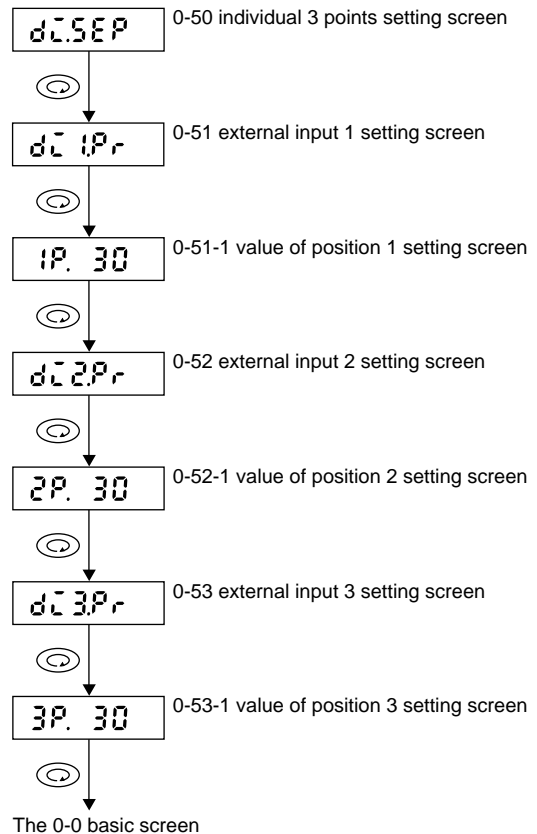


In the case of no change on the value of position setting screen (the decimal point of the rightmost digit does not flash), just press the  $\odot$  key, and the next, external input 2 setting screen is displayed. The same applies to the 0-52-1 value of position 2 setting screen and the 0-53-1 value of position 3 setting screen.

When value of position is selected on each value of position setting screen:  $1P.$ ,  $2P.$  and  $3P.$  are displayed respectively on the 0-51-1 external input 1 screen, the 0-51-2 external input 2 screen and the 0-51-3 external input 3 screen.

③ Example of Sequential Screen Changes from Individual Setting Screen:

When the selection and setting on the external input individual setting screen are completed and the  $\odot$  key is pressed, screens are changed sequentially as shown in the following example (where set values have been already registered). To change any value, use the  $\blacktriangle$  or  $\blacktriangledown$  key and press the  $\text{ENT}$  key for registration.



(7) Setting of 7 Values of Position

(0-60 7 values of position setting screen  $dLPr$  1, 0-61 value of position 1 setting screen  $1P.$ , 0-62 value of position 2 setting screen  $2P.$ , 0-63 value of position setting screen  $3P.$ , 0-64 value of position 4 setting screen  $4P.$ , 0-65 value of position 5 setting screen  $5P.$ , 0-66 value of position 6 setting screen  $6P.$ , 0-67 value of position 7 setting screen  $7P.$ . The setting range of values of position (preset) is between 0% and 100%. The initial value is 0%.)

To begin with, the 0-60 7 values of position setting screen  $dLPr$  1, this screen is registered by pressing the  $\text{ENT}$  key.

Exclusively for position setting, 7 values of position in total can be set. In this case, external input signals are treated as binary numerals of 2.

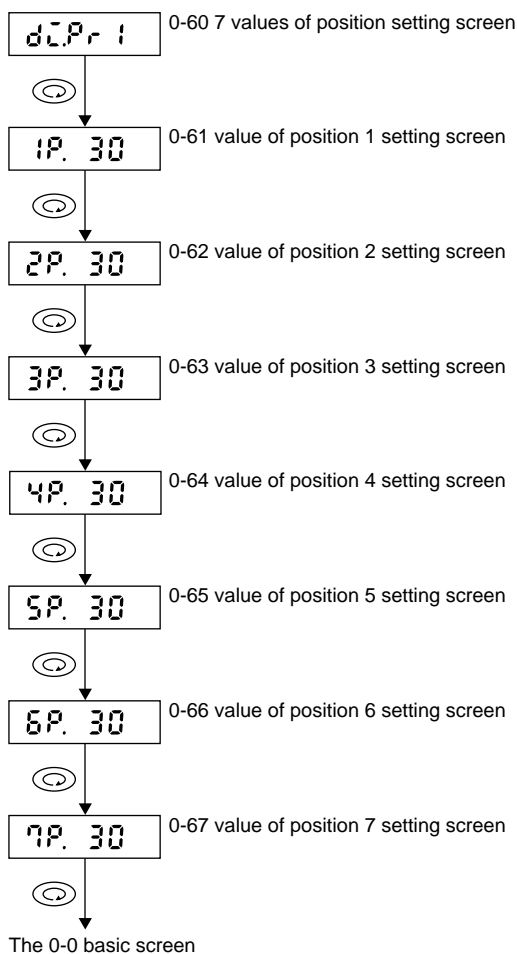
① Setting of Value of Position

When the  $\odot$  key is pressed on the 0-60 7 values of position setting screen, the value of position 1 setting screen appears.

On this screen, change the numerical value by pressing the  $\blacktriangle$  or  $\blacktriangledown$  key. Once an intended value is reached, press the  $\text{ENT}$  key to register. The decimal points stops flashing.

The values of position 1 through 7 can be set by the same procedure. Use the  $\odot$  key to proceed from the value of position 1 setting screen successively to the value of position 7 setting screen. When the  $\odot$  key is pressed on the value of position 7 setting screen, the basic screen returns.

Seven values of position are set by binary operation of 3 input points; external input 1, external input 2 and external input 3.



② Binary Selection

Seven values of position from the position 1 through the position 7 are assigned to the 3 external input terminals of the instrument, i.e., external input 1 (DI1), external input 2 (DI2) and external input 3 (DI3) as shown below:

Binary Table The ● mark indicates "switch ON."

Input	Value of degree of opening (preset) No.						
	1P.	2P.	3P.	4P.	5P.	6P.	7P.
External input 1	●		●		●		●
External input 2		●	●			●	●
External input 3				●	●	●	●

(8) Setting of 3 Values of Position and Individual 1 Point

(0-70 7 value of position setting screen  $d\bar{c}P_r 2$ , 0-71 Value of position 1 setting screen  $1P.$ , 0-72 value of position 2 setting screen  $2P.$ , 0-73 value of position 3 setting screen  $3P.$ , 0-74 external input 3 setting screen  $d\bar{c}3no$ . The setting range of values of position (preset) is between 0% and 100%. The initial value is 0%.)

To begin with, the 0-70 3 values of position and individual 1 point setting screen  $d\bar{c}P_r 2$  is registered by pressing the  $\text{ENT}$  key.

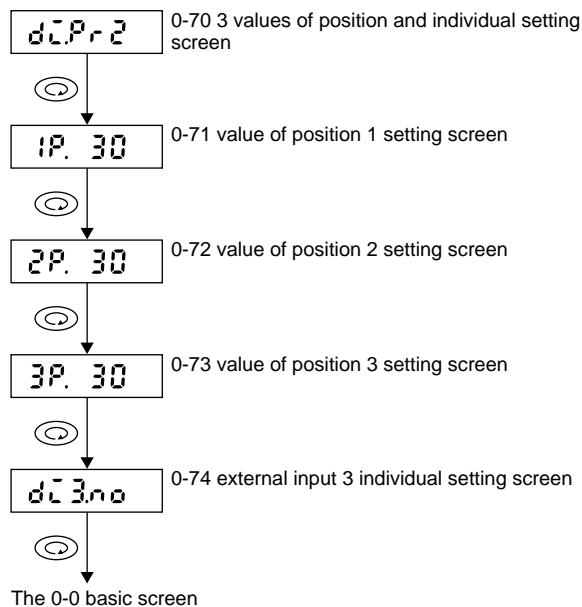
Three values of position in total can be set and one of individual setting items (switching of output characteristics, switching of operation/suspension, and setting of value of position) can be selected.

① Setting of Values of Position

When the  $\text{ENT}$  key is pressed on the 0-70 3 values of position and individual 1 point setting screen, the value of position 1 setting screen appears.

On this screen, change a numerical value by using the  $\blacktriangle$  or  $\blacktriangledown$  key. Once an intended value is reached, press the  $\text{ENT}$  key to register it. The decimal point stops flashing.

The values of position 1 through 3 can be set by the same procedure. Use the  $\text{ENT}$  key to proceed from the value of position 1 setting screen to the value of position 3 setting screen successively. When the  $\text{ENT}$  key is pressed on the value of position 3 setting screen, the basic screen returns. Set 3 values of position by binary operation of 2 input points; external input 1 (DI1) and external input 2 (DI2) and use external input 3 (DI3) for individual setting.



For external input 3 (DI3), please refer to (6) Setting of Individual 3 Point External Input.

For external input 1 (DI1) and external input 2 (DI2), the values of position 1 through 3 are assigned as shown in the table below.

Binary Table The ● mark indicates "switch ON."

Input	Value of degree of opening (preset) No.		
	1P.	2P.	3P.
External input 1	●		●
External input 2		●	●

② Setting on the Individual Setting and Value of Position Setting Screen

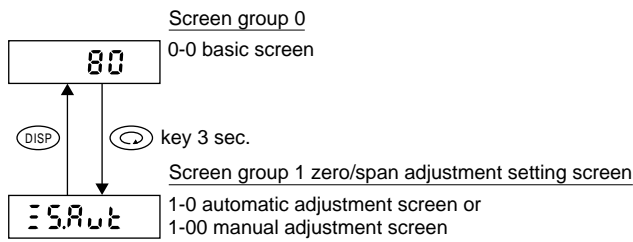
The setting range of values of position (preset) is from 0% to 100% and the initial value is 0%.

On the 0-74 external input 3 individual setting screen, selection from  $\text{OFF}$ : No setting (initial value),  $rR$ : Reverse characteristics,  $St$ : Stand-by (waiting) and  $P_r$ : Value of position (preset) is possible. When value of position ( $P_r$ ) is selected, the 0-74-1 value of position setting screen is called. Press the  $\blacktriangle$  or  $\blacktriangledown$  key on this screen to change a numerical value. Once an intended value is reached, press the  $\text{ENT}$  key to register it. The decimal point stops flashing. Upon setting, press the  $\text{ENT}$  key to return to the 0-0 basic screen.

6-4. Screen Group 1 and Parameter Setting

① Moving from Screen Group 0 to Screen Group 1

When the  $\text{ENT}$  key is pressed continuously for 3 seconds on the 0-0 basic screen, the 1-0 zero/span automatic adjustment screen or the 1-00 zero/span manual adjustment screen of the screen group 1 is displayed. To return to the 0-0 basic screen, press the  $\text{DISP}$  key.



## ② Need of Zero/Span Adjustment

The zero/span adjustment makes adjustment when the fully opened condition (100%) or the fully closed condition (0%) is reached in an incorrect position. There are two types of adjustments, automatic and manual. Connected to a control motor or the like, the instrument checks and adjusts the zero side and the span side of the rotating position of the motor shaft. If getting out of position is found at the time of maintenance/replacement of the control motor, readjustment should be made. Make sure to carry out zero/span adjustment before using the instrument.

## ③ Preparations for adjustment

- 1) Before zero/span adjustment, do not forget to check all the wiring.
- 2) During zero/span adjustment, checking may not be possible for some erroneous wiring. Watch for erroneous wiring.
- 3) Before zero/span adjustment, confirm the direction of revolution of the motor by the use of the ▲ and ▼ keys as described in 6-3 (2) Manual Operation. When confirmed, release the manual operation (the MAN display lamp goes out). Zero/span adjustment is not possible in manual operation.

Use the ▲ and ▼ for switching between the 1-0 zero/span automatic screen and the 1-00 zero/span manual screen and the (ENT) key for registration.

## (1) Zero/Span Automatic Adjustment

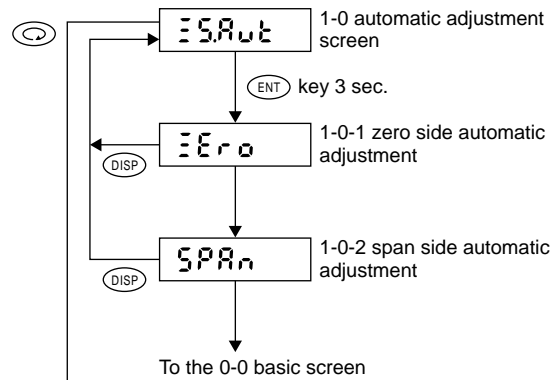
(1-0 automatic adjustment screen ≡SARn [initial value], 1-0-1 zero side automatic adjustment screen ≡Ero, 1-0-2 span side automatic adjustment screen ≡SPAn)

### ① Zero Side Automatic Adjustment

- 1) Press the (ENT) key on the 1-0 automatic adjustment screen to proceed to the 1-0-1 zero side automatic adjustment screen, which flashes during adjustment.
- 2) During zero side automatic adjustment, it is possible to interrupt automatic adjustment and return to the 1-0 automatic adjustment screen by using the (DISP) key.

### ② Span Side Automatic Adjustment

- 1) When the zero side automatic adjustment is completed, the span side automatic adjustment screen automatically appears and the screen flashes.
- 2) During span side automatic adjustment, it is possible to interrupt automatic adjustment and return to the 1-0 automatic adjustment screen by using the (DISP) key.
- 3) Upon completion of automatic adjustment on the span side automatic adjustment screen, the 0-0 basic screen automatically returns.



The 1-1 even 1 screen (option) or the 1-10 screen, which are described from the next page on.

## (2) Zero/Span Manual Adjustment

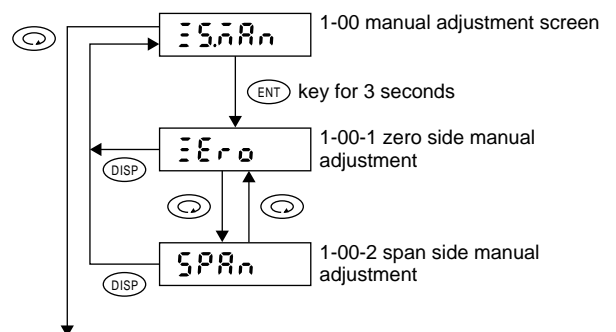
(1-00 manual adjustment screen ≡SARn, 1-00-1 zero side manual adjustment screen ≡Ero, 1-00-2 span side manual adjustment screen ≡SPAn)

### ① Zero Side Automatic Adjustment

- 1) Press the (ENT) key on the 1-00 manual adjustment screen to proceed to the 1-00-1 zero side manual adjustment screen, which flashes during adjustment.
- 2) During zero side manual adjustment, it is possible to interrupt manual adjustment and return to the 1-00 manual adjustment screen by using the (DISP) key.
- 3) Operate the motor by means of the ▲ and ▼ keys and register zero side data on the zero side by means of the (ENT) key. At that time, make sure to adjust zero side data so as to be less than span side data.
- 4) Call the 1-00-2 span side manual adjustment screen by using the (ENT) key.






### ② Span Side Manual Adjustment

- 1) When the (ENT) key is pressed on the 1-00-1 zero side manual adjustment screen, the 1-00-2 span side manual adjustment screen is displayed and the screen flashes during the adjustment.
- 2) During span side manual adjustment, it is possible to interrupt manual adjustment and return to the 1-00 manual adjustment screen by using the (DISP) key.
- 3) Operate the motor by means of the ▲ and ▼ keys and register span side data on the span side by means of the (ENT) key. At that time, make sure to adjust span side data so as to be more than zero side data.
- 4) Proceed to the 1-00-1 zero side adjustment screen by using the (ENT) key.



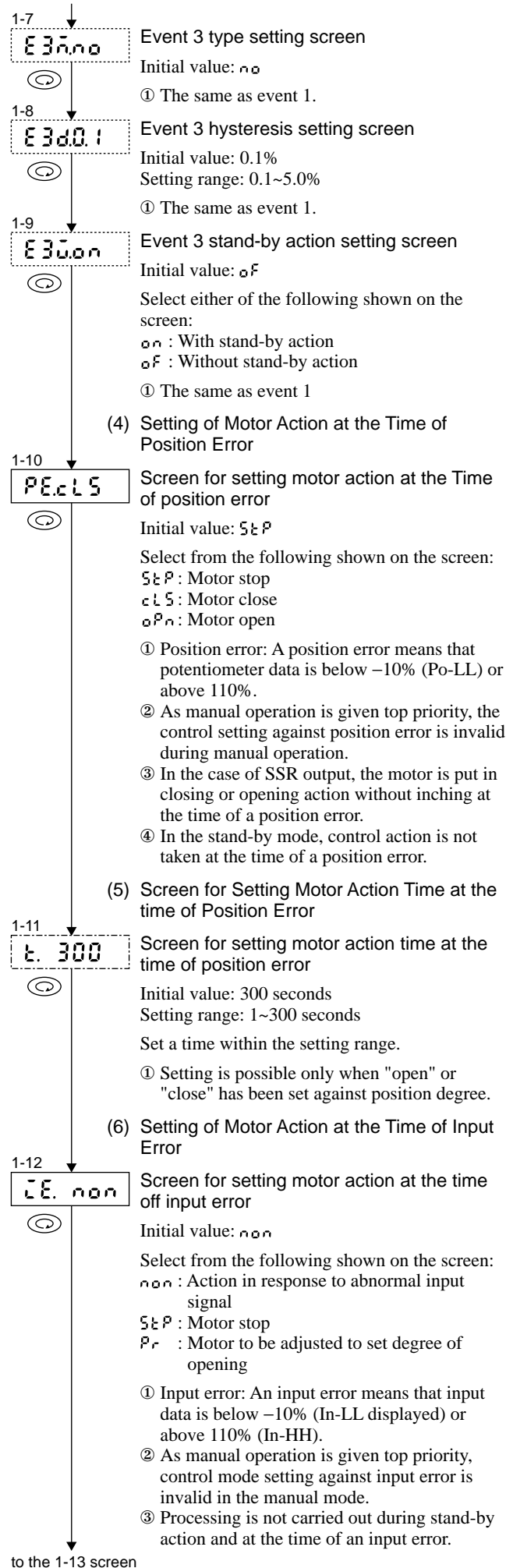
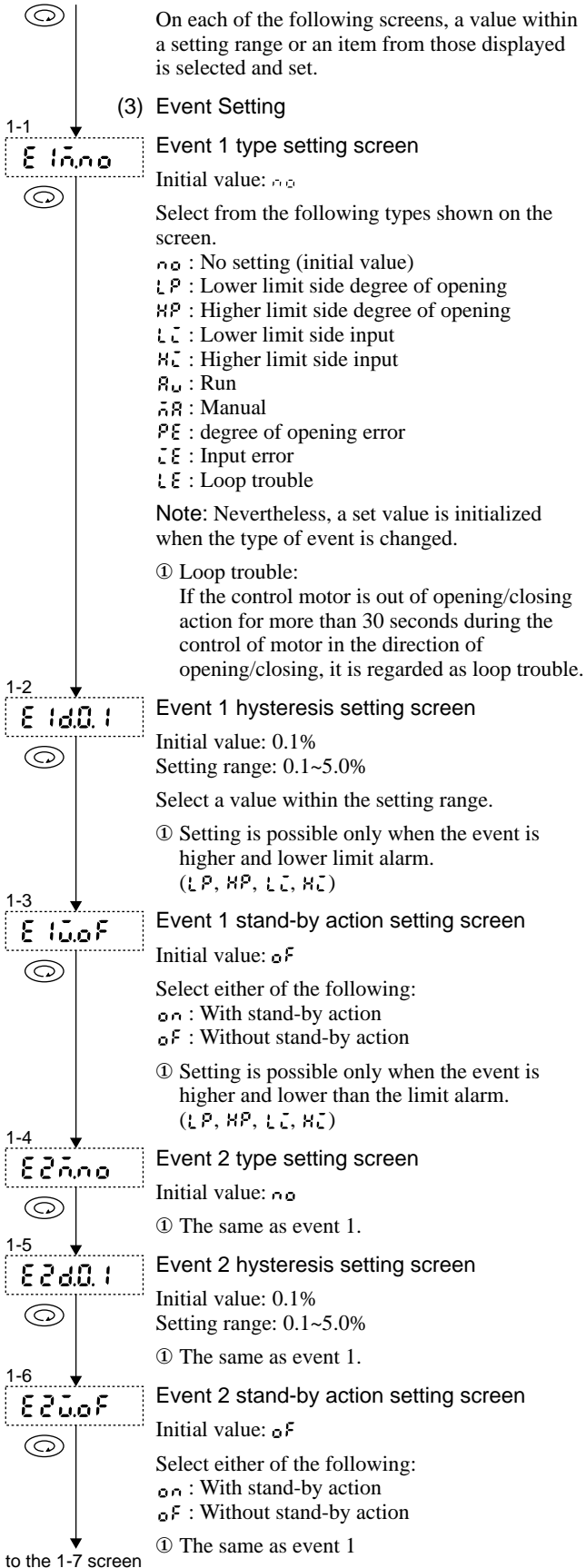
The 1-1 event 1 screen (option) or the 1-10 screen, which are described from the next page on.

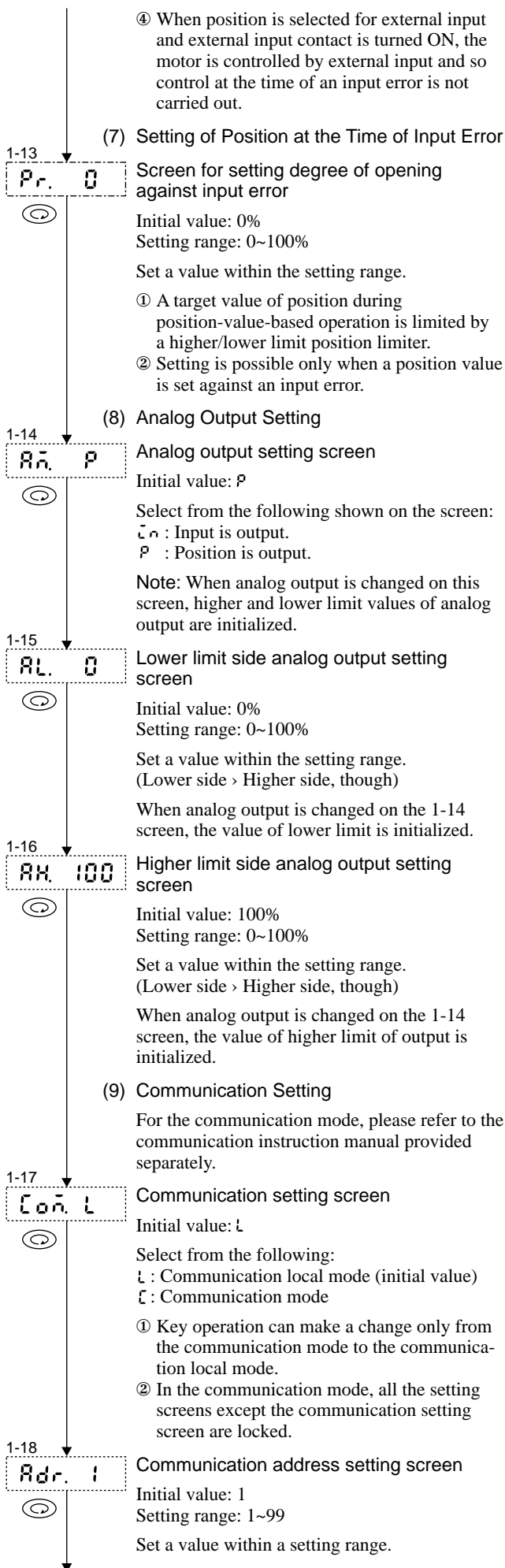
## Key Operation

The  and  keys are used for selection on a screen and an item or a numerical value is registered by means of the  key. To return to the preceding setting screen, press the  key. When the  key is pressed, the 1-0 or 1-00 basic screen is returned.

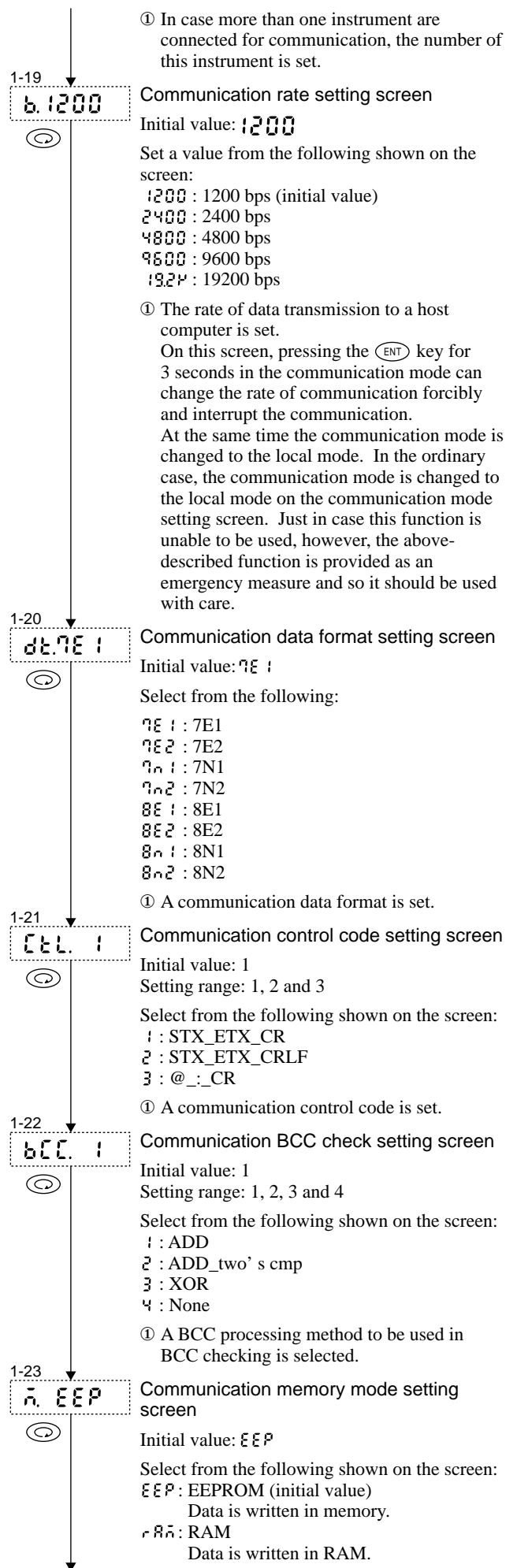
## Screen Group 1

1-0 automatic adjustment screen or 1-00 manual adjustment screen is the starting screen.





to the 1-19 screen



to the 1-24 screen

1-24  
**dl 20**  
 Communication delay time setting screen  
 Initial value: 20  
 Setting range: 0~100  
 Set a value within the setting range.  
 ① A delay time from receiving a communication command to carrying out transmission is set.  
 ② Delay time = Set value of communication delay time × 0.25 msec.

(10) Input Range Setting

1-25  
**r4\_20**  
 Input range setting screen  
 Initial value:  
 4\_20 in the case of current input  
 0\_10 in the case of voltage input  
 Select one from the following input ranges:

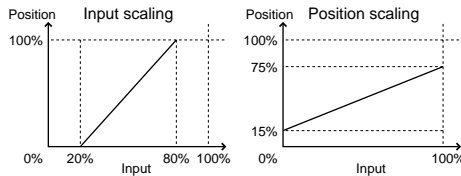
Current input: 4\_20 : 4~20mA (initial value)  
 0\_20 : 0~20mA  
 Voltage input: 0\_10 : 0~10V (initial value)  
 0\_5 : 0~5V  
 1\_5 : 1~5V

(11) Input Filter Setting

1-26  
**F. 0**  
 Input filter setting screen  
 Initial value: 0 second  
 Setting range: 0~99 seconds  
 Select a value within a setting range.  
 ① The filter removes noise contained in input signals sent from the controller and stabilizes the control.

(12) Setting of Input Scaling/Position Scaling

1-27  
**ScL. ̄**  
 Screen for setting input scaling/degree of opening scaling  
 Initial value: ̄  
 Select from the following shown on the screen;  
 ̄ : Input scaling (initial value)  
 P : Position scaling  
 ① Either input scaling or position scaling is to be selected. When a selected scaling is changed to the other, the lower and higher limit sides are initialized to 0% and 100% respectively. Refer to the diagrams below.



- ② Input scaling: Higher and lower limit values of input are set respectively against 0% and 100% positions.  
 ③ Position scaling: Higher and lower limit positions are set respectively against 0% and 100% inputs.

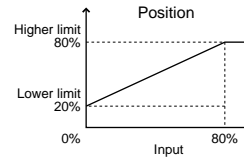
1-28  
**L. 0**  
 Scaling lower limit setting screen  
 Initial value: 0%  
 Setting range: —10~109%  
 Set a value within the setting range.  
 (lower limit < higher limit)  
 A lower limit value is always smaller than a higher limit value.

to the 1-29 screen

1-29  
**H. 100**  
 Scaling higher limit setting screen  
 Initial value: 100%  
 Setting range: -9~110%  
 Set a value within the setting range.  
 (lower limit < higher limit)

(13) Position Limiter Setting

1-30  
**PL. 0**  
 Screen for setting lower limit of position limiter  
 Initial value: 0%  
 Setting range: 0~99%  
 Set a value within a setting range.  
 (lower limit < higher limit)  
 Refer to the diagram below.

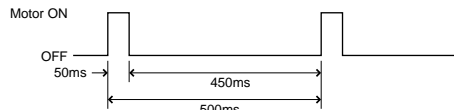


1-31  
**PH. 100**  
 Screen for setting higher limit of position limiter  
 Initial value: 100%  
 Setting range: 1~100%  
 Set a value within a setting range.  
 (lower limit < higher limit)

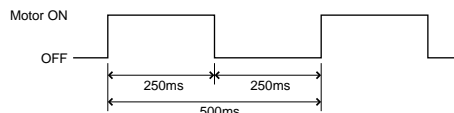
(14) Motor Action Time Setting

1-32  
**Q. 100**  
 Motor action time setting screen  
 Initial value: 100%  
 Setting range: 10~100%  
 Set a value within the setting range.  
 (lower limit < higher limit)  
 ① A motor action time can be set only in the case of SSR output.  
 Motor action is controlled with 500 msec as a cycle. Please refer to the following diagrams.

- Motor action time set at 10%



- Motor action time set at 50%



(15) Setting of Square Root Extraction Function

1-33  
**Sq of**  
 Screen for setting square root extraction function  
 Initial value: of  
 Select from the following shown on the screen:  
 on : With square root extraction  
 of : Without square root extraction  
 ① The extraction of square root function improves flux control characteristics when an electric valve and an electric damper are used at operating ends.

to the 1-34 screen



1-34 (16) Output Characteristics Setting  
Act.dA

Output characteristics setting screen

Initial value: dA

Select from the following shown on the screen:

- dA : Direct characteristics (initial value)
- rA : Reverse characteristics

- ① Direct characteristics (DA): Control is carried out in the state that the direction in which input increases and decreases is the same as the direction in which the value of position increases and decreases.
- ② Reverse characteristics (RA): Control is carried out in the state that the direction in which input increases and decreases is opposite to the direction in which the value of position increases and decreases.

Note: In case rA is selected for external input, setting is not possible and the screen is for monitoring only. Even when rA is cancelled for external input, the status before the cancellation is maintained.

1-35 (17) Dead Band (insensitive area) Setting  
db. 2.0

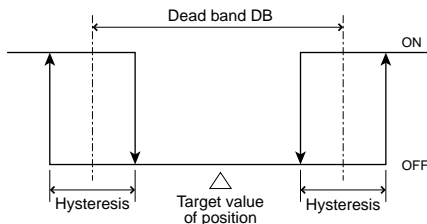
Dead band setting screen

Initial value: 2.0%

Setting range: 0.5~10.0%

Set a value within the setting range.

Please refer to the diagram below:



- ① Control turns round in a dead band. In the dead band, the position at the time is maintained and the motor operates neither in the opening direction nor in the closing direction. When a larger value is set for dead band, the sensitivity for turning round becomes dull.
- ② Hysteresis: should be set at 1/4 of the dead band. If dead band is less than 1.2% of input, hysteresis is fixed to 0.3%.

1-36 (18) Keylock Setting  
Plc. 0

Keylock setting screen

Initial value: 0

Setting range: 0, 1, 2 and 3

Select from the following shown on the screen:

- 0 : Without keylock (initial value)
- 1 : Keylock of screen group 1
- 2 : Keylock of all except those for manual operation
- 3 : All keylock (In manual operation, however, opening and closing of motor can be controlled by the ▲ and ▼ keys although setting is not possible.)

- ① This function can lock all keys so that they do not work when pressed down.

To the 1-0 automatic adjustment screen or 1-00 manual adjustment screen.

## 7. Summary of Convenient Functions (Useful functions are explained briefly.)

Function	Summary	Page
① Manual operation	For trial run and maintenance/inspection and in emergency, automatic operation is released and manual position control is enabled.	8
② Switching between run/stand-by	For trial run and maintenance/inspection or in an emergency, operation can be suspended (stand-by or waiting action). Then, the STBY lamp (green) on the front panel lights and control output stops.	9
③ Event (option)	Of the 9 functions; position higher/lower limit absolute value alarms, input from controller higher/lower limit absolute value alarms, automatic operation, manual operation, occurrence of position error, occurrence of error of input from controller error and control loop trouble; three can be selected as events (auxiliary output signals) for contact output.	14
④ External operation	For actions in automatic operation, switching of output characteristics, switching between operation and suspension, and position setting can be carried out by external input (no-voltage contact or open collector). In case position setting has been made, the position used during the automatic operation is changed to a newly set value. It takes an ON time of 0.2 seconds or longer for external input to become effective. The following three types of setting modes by external input are available:	10
1) Individual 3 points	Three in total are selectable, i.e., switching of output characteristics, switching between operation and suspension (stand-by), and position setting.	10
2) 7 values of position	In the mode used only for position setting, 7 values of position in total are selectable. In this case, external input signals are treated as binary numerals.	11
3) 3 values of position and individual 1 point	3 values of position and one individual setting (switching of output characteristics, switching between operation/suspension (stand-by) or position setting) are selectable.	12
⑤ Position at the time of error	A motor action which is safe enough at the time of a position error (error of electric potential input from control motor) or an input error (error of input signal from controller) can be set.	14
1) In the case of position error	Selectable from 3 types: Suspension (stand-by action), closing and opening of motor by setting its action time.	14
2) In the case of input error	Selectable from suspension (stand-by action) and setting of position (0~100%).	14
⑥ Communication (option)	Communication setting is possible. For details, please refer to the communication instruction manual.	15
⑦ Input filter	To remove the noise content of input signals sent from controller.	16
⑧ Input scaling	Against 0~100% position outputs, scaling of input signals from controller can be carried out freely within a 0~100% range. (Higher limit/lower limit variable.)	16
⑨ Position scaling	Against 0~100% input signals from controller, scaling of values of position can be carried out freely within a 0~100% range. (Higher limit/lower limit variable.)	16
⑩ Position limiter	This is the function to cause a limiter (restriction) to work on higher and lower limits of position. For instance, the higher limit of position is 100% (fully opened) but it is possible to make 80% the highest level; the lower limit of degrees of opening is 0% (fully closed) but it is possible to make 20% the lowest level.	16
⑪ Adjustment of length of time of control motor revolution	Although the speed of revolution of the control motor is fixed by rating, the length of time in which the motor is in action can be adjusted by controlling ON/OFF time of control output to motor in automatic operation. This becomes invalid in manual operation, though (when combined output of SSR and contact is used).	16
⑫ Square root extraction function (option)	This function improves flux control characteristics in using an electric valve, an electric damper or the like as an operating end.	16
⑬ Keylock	Operating keys can be locked to keep them ineffective. Four conditions are selectable: No keylock, keylock of the screen group 1, keylock except manual operation and all keylock.	17

## 8. Maintenance and Troubleshooting

### 8-1. Action upon Recovery from Power Failure

① Control Output in Automatic Operation:

In accordance with automatic control conditions at the time of recovery.

② Event Output in Automatic Operation:

In accordance with automatic control conditions at the time of recovery in case the stand-by action has not been selected. With the stand-by action, however, output before power failure is cancelled.

③ Control Output in Manual Operation:

Return to conditions of manual operation before power failure.

④ Error Display:

If an error condition before power failure remains when recovered, an error message will be displayed.

### 8-2. Procedure of Maintenance Replacement and Matters to Be Attended to

① Confirmation of Model Code:

Check the model code of the component part in trouble. (Open the control box, and you can find an appropriate code in the model label affixed to the instrument case.)

② Inquiry on Input Data:

Ask the manufacturer if input data (control date of external operation, event output, set value of position, etc., at the time when an error occurs) is necessary or not.

③ Confirmation of Present Wiring Condition:

In case replacement is required, check and record the present wiring condition. Please note that in the case of external control for which terminal data is necessary, the same control operation as before is not possible with a replaced product unless such data is input.

④ Confirmation of Present Input Data:

When data is not known, call and record it. In case input data is required, the same control operation as before is not possible with a replaced product unless such data is input.




⑤ Repair of Present Product or Procurement of New Product:

In case the product in trouble is removable from the site of installation, remove and repair it. If it is not possible, arrange to acquire a new product for replacement.

⑥ Trial Run and Adjustment:

When replaced by a new product, carry out adjustment for a trial run as described in 5-1. Procedure of Adjustment for Trial Run.

### 8-3. Cause of Trouble and Troubleshooting

Problem	Cause	Remedy
① Error code is displayed.	Refer to "Error Codes, Causes and Remedies."	Refer to "Error Codes, Causes and Remedies."
② Directions of opening action and closing action are inverted.	Erroneous wiring to potentiometer of control motor or for control signals.	Correct wiring to potentiometer of control motor (terminals 4, 5, and 6) or for control signals (terminals 15, 16 and 17).
③ Hunting (frequent repetition of turning round)	① Input to the instrument is instable. ② Dead band (insensitive area) is too small.	① Check input on the 0-0-1 screen. Also check wiring for connection to terminals 2 and 3. ② Increase dead band (insensitive area).
④ Full open or full close position is not correct.	① Zero/span position is not correct. ② Deterioration of potentiometer or some other part of control motor.	① Carry out zero/span adjustment. ② Examine and repair control motor.
⑤ Control motor does not operate.	① Problem with power supply or wiring connection. ② Operation is frozen due to manual control. ③ Deterioration of control motor. ④ Deterioration of EM70.	① Examine power source and wiring connection particularly for burnout. (Terminals 4, 5, 6), (Terminals 15, 16 and 17). ② Release manual control and change to automatic operation. ③ Examine and repair control motor. ④ Examine and repair or replace EM70.
⑥ Display on the instrument front panel goes out and the instrument is unable to be put in operation.	① Problem with power supply or wiring connection. ② Deterioration of EM70.	① Examine power source and wiring connection particularly for burnout. (Terminals 4, 5, 6), (Terminals 15, 16 and 17). ② Examine EM70 and repair or replace.
⑦ Keys unable to be operated.	① Keylock is in effect. ② Deterioration of EM70. ③ On communication setting screen, the communication mode (  ) has been set.	① Release keylock. ② Examine and repair or replace EM70. ③ Change the communication setting to the local mode (  ).
⑧ Problem with position data display	Usually the POSITION lamp (green) lights when a value of position is shown on data display but it can be changed to input display or target value of position/deviation display by switching operation.	Press  key to light the POSITION lamp (green) for ordinary position display.

8-4. Error Codes, Causes and Remedies

Error codes	Problem	Cause	Remedy
Po_HH (Po-HH)	The value of position exceeded full open (100%) and higher limit (+110%).	<ul style="list-style-type: none"> <li>① Erroneous wiring connection to potentiometer of control motor</li> <li>② Deterioration of potentiometer of control motor</li> <li>③ Deterioration of other parts inside the control motor</li> </ul>	<ul style="list-style-type: none"> <li>① Check wiring connection to potentiometer of control motor, particularly for burnout. (Terminals 4, 5 and 6)</li> <li>② Examine and repair or replace control motor.</li> <li>③ Examine and repair or replace control motor.</li> </ul>
Po_LL (Po-LL)	The value of position fell below full close (0%) and lower limit (-10%).	<ul style="list-style-type: none"> <li>① Erroneous wiring connection to potentiometer of control motor</li> <li>② Deterioration of potentiometer of control motor</li> <li>③ Deterioration of other parts inside the control motor</li> </ul>	<ul style="list-style-type: none"> <li>① Check wiring connection to potentiometer of control motor, particularly for burnout. (Terminals 4, 5 and 6)</li> <li>② Examine and repair or replace control motor.</li> <li>③ Examine and repair or replace control motor.</li> </ul>
In_HH (in-HH)	Input signal from controller exceeded full open position (100%) and higher limit (+110%).	<ul style="list-style-type: none"> <li>① Problem with wiring connection for input from controller</li> <li>② Defective or unsuitable output signals from controller</li> </ul>	<ul style="list-style-type: none"> <li>① Check wiring connection for input signal from controller. (Terminals 2 and 3)</li> <li>② Examine and correct or change output signal.</li> </ul>
In_LL (in-LL)	Input signal from controller fell below full close position (0%) and lower limit (-10%).	<ul style="list-style-type: none"> <li>① Problem with wiring connection for input from controller</li> <li>② Defective or unsuitable output signals from controller</li> </ul>	<ul style="list-style-type: none"> <li>① Check wiring connection for input signal from controller. (Terminals 2 and 3)</li> <li>② Examine and correct or change output signal.</li> </ul>
ZS_Er (ZS-Er)	Error occurred on zero/span automatic adjustment screen.	<ul style="list-style-type: none"> <li>① Problem with wiring connection to potentiometer of control motor</li> <li>② Problem with wiring connection for operation signal of control motor</li> </ul>	<ul style="list-style-type: none"> <li>① Check wiring connection to potentiometer of control motor, particularly for burnout. (Terminal 4, 5 and 6)</li> <li>② Check wiring connection for control signal of control motor, particularly for burnout. (Terminals 15, 16 and 17)</li> </ul> <p>Once the cause is found and remedial action ① or ② is taken, press the <b>DISP</b> key to return to the zero/span automatic adjustment</p>
ZS_Er (ZS-Er)	Error occurred on zero/span manual adjustment screen.	<ul style="list-style-type: none"> <li>① Problem with wiring connection to potentiometer of control motor</li> <li>② Problem with wiring connection for control signal of control motor</li> <li>③ Zero side data increased over span side data</li> </ul>	<ul style="list-style-type: none"> <li>① Check wiring connection to potentiometer of control motor, particularly for burnout. (Terminals 4, 5 and 6)</li> <li>② Check wiring connection for control signal of control motor, particularly for burnout. (Terminals 15, 16 and 17)</li> <li>③ Adjust so that zero side data becomes smaller than span side data.</li> </ul> <p>Once the cause is found and remedial action ①, ② or ③ is taken, press the <b>DISP</b> key to return to the zero/span automatic adjustment screen.</p>

**9. Record of Parameter Setting** (For convenience sake, recording set values and selected items is recommended.)

Screen No.	Parameter (Item)/screen display	Initial value	Setting/Selection	Record
0-1	Operation/Suspension switching	md. ( $\bar{n}d.$ )	run	
0-2	Event 1 set value	1E. ( $1E.$ )	no	
0-3	Event 2 set value	2E. ( $2E.$ )	no	
0-4	Event 3 set value	3E. ( $3E.$ )	no	
0-50	External input individual 3 points setting	di. ( $d\bar{i}.$ )	SEP	
0-51	External input 1 individual setting	di1. ( $d\bar{i}1.$ )	no	
0-51-1	External input 1 value of position setting	1P. ( $1P.$ )	0	
0-52	External input 2 individual setting	di2. ( $d\bar{i}2.$ )	no	
0-52-1	External input 2 value of position setting	2P. ( $2P.$ )	0	
0-53	External input 3 individual setting*1	di3. ( $d\bar{i}3.$ )	no	
0-53-1	External input 3 value of position setting*2	3P. ( $3P.$ )	0	
0-60	Binary 7 values of position setting	di. ( $d\bar{i}.$ )		
0-61	Value of position 1*3	1P. ( $1P.$ )	0	
0-62	Value of position 2*4	2P. ( $2P.$ )	0	
0-63	Value of position 3*5	3P. ( $3P.$ )	0	
0-64	Value of position 4	4P. ( $4P.$ )	0	
0-65	Value of position 5	5P. ( $5P.$ )	0	
0-66	Value of position 6	6P. ( $6P.$ )	0	
0-67	Value of position 7	7P. ( $7P.$ )	0	
0-70	Binary 3 values of position and individual 1 point	di. ( $d\bar{i}.$ )		
0-71	Value of position 1*3	1P. ( $1P.$ )	0	
0-72	Value of position 2*4	2P. ( $2P.$ )	0	
0-73	Value of position 3*5	3P. ( $3P.$ )	0	
0-74	External input 3 individual setting*1	di3. ( $d\bar{i}3.$ )	no	
0-74-1	External input 3 value of position*2	3P. ( $3P.$ )	0	
1-0	Zero/span adjustment	ZS. ( $ZS.$ )	Auto	
1-1	Event 1 type setting	E1m. ( $E1\bar{m}.$ )	no	
1-2	Event 1 hysteresis	E1d. ( $E1d.$ )	0.1	
1-3	Event 1 stand-by action	E1W. ( $E1\bar{w}.$ )	oF	
1-4	Event 2 type setting	E2d. ( $E2d.$ )	no	
1-5	Event 2 hysteresis	E2m. ( $E2\bar{m}.$ )	0.1	
1-6	Event 2 stand-by action	E2W. ( $E2\bar{w}.$ )	oF	
1-7	Event 3 type setting	E3m. ( $E3\bar{m}.$ )	no	
1-8	Event 3 hysteresis	E3d. ( $E3d.$ )	0.1	
1-9	Event 3 stand-by action	E3W. ( $E3\bar{w}.$ )	oF	
1-10	Control at the time of position error	PE. ( $PE.$ )	SEP	
1-11	Opening/closing time at the time of position error	t. ( $t.$ )	300	
1-12	Control at the time of input error	iE. ( $iE.$ )	non	
1-13	Opening/closing time at the time of input error	Pr. ( $Pr.$ )	0	
1-14	Analog output	Am. ( $A\bar{m}.$ )	P	
1-15	Lower limit side analog output	AL. ( $AL.$ )	0	
1-16	Higher limit side analog output	AH. ( $AH.$ )	100	
1-25	Input range: Current	r. ( $r.$ )	4.20	
	Voltage	r. ( $r.$ )	0.10	
1-26	Input filter	F. ( $F.$ )	0	
1-27	Scaling	ScL. ( $ScL.$ )	1	
1-28	Lower limit side scaling	L. ( $L.$ )	0	
1-29	Higher limit side scaling	H. ( $H.$ )	100	
1-30	Lower limit side position limiter	PL. ( $PL.$ )	0	
1-31	Higher limit side position limiter	PH. ( $PH.$ )	100	
1-32	Motor speed	G. ( $G.$ )	100	
1-33	Square root extraction	Sq. ( $Sq.$ )	oF	
1-34	Output characteristics	Act. ( $Act.$ )	dR	
1-35	Dead band	db. ( $db.$ )	20	
1-36	Keylock	KLc. ( $KLc.$ )	0	



Note: For \*1, \*2, \*3, \*4 and \*5, the same numerical value or data should be used.

Prepared on: \_\_\_\_\_, 200\_\_

Prepared by \_\_\_\_\_

Memo

## 10. Specifications

- Display
  - Position indicator
    - Output display color (LED bar graph) : Green
    - Display resolution/dot : 5%/20 dots
  - Data display
    - Display digit/color : 5 digits/7 segments LED green display, Height of character: 14 mm
    - Display resolution : 1% (position, target value of position), 0.1% (input)
    - Sampling cycle : 0.2 seconds
    - Display range : Position and deviation: -10~110%, Input value: -10.0~110.0%
  - Status display
    - Position display : (POSITION)/Green
    - Input display : (INPUT)/Green
    - Target value of position/deviation display : (DES/DEV)/Green
    - Manual action : (MAN)/Green
    - Reverse action : (RA)/Green
    - Opening action : (OPEN)/Green
    - Closing action : (CLOSE)/Green
    - External (DI) input : (DI1, 2, 3)/Green
    - Event action : (EV1, 2, 3)/Orange
    - Stand-by action : (STBY)/Green
    - Communication status : (COM)/Green
- Control input
  - Current/receiving impedance : 4~20, 0~20 mA DC/100Ω
  - Voltage/input impedance : 1~5V, 0~5V, 0~10V DC/1MΩ
  - Input filter : 0~99 seconds
  - Isolation : Control input not insulated from feedback electric potential and DI input  
Control input insulated from analog output
- Setting
  - Setting system : By key switches (6 keys) on front panel
  - Setting/selection item
    - Display switching : By  key switch on front panel
    - Auto/manual switching : By  key switch on front panel
    - Zero/span adjustment : Provided with Automatic adjustment function; manual adjustment is also possible (correction of potentiometer error)
    - Selection of control characteristics : Direct (DA)/reverse (RA)
    - Control characteristics gain setting : Input values corresponding to 0% position and 100% position (scaling function) or position values corresponding to 0% input and 100% input (scaling function)
    - Position limiter setting : Higher limit value 1~100%, Lower limit value 0~99% (higher limit>lower limit)
    - Setting of speed (inching) : 10~100% (Initial value: 100%, which means no inching) In the case of contact output, setting of speed is not possible.
    - Hysteresis : 1/4 of dead band. Fixed to 0.3% when dead band is less than 1.2% of input.
    - Dead band setting : 0.5~10.0% of input signal (Initial value: 2.0%)
    - Keylock : 3-stage lock
- Feedback
  - Feedback potentiometer rating : Any between 100Ω and 2kΩ/ three-wire type
- Control output
  - Output type
    - Contact : 240V AC 2A
    - Combination of SSR and contact : 240V AC 2A
- External operation input (DI)
  - Number of points : 3 points (DI1, DI2 and DI3)
  - Operable items
    - (1) Individual assignment to RA, STBY and present position value is possible.
    - (2) Assignment to 7 preset position values by binary numerals is possible.
    - (3) Assignment to 3 present position values and individual assignment to one of RA, STBY and preset position value is possible.
  - Operation : Put in action when no-voltage contact or open collector turns ON.
- Event output (option)
  - Number of event points : 3 points (EV1, EV2 and EV3)
  - Types
    - Electric potential (higher limit, lower limit, hysteresis variable and stand-by action selectable), input (higher limit, lower limit, hysteresis variable and stand-by action selectable), operation, manual, potentiometer error, input error, and control loop trouble.
    - Output rating/structure : 240V AC 1A Resistive load / "a" contact
    - Action display : When EV1~EV3 are in action, orange lamp lights.
- Analog output (option)
  - Number/type : 1 point, either position or control input to be selected
  - Analog output/rating : 4~20 mA FS/Load resistance 300Ω or less
  - Output accuracy : ±0.5% FS or less
  - Isolation : Analog output insulated from control input and feedback potentiometer
- Square root extraction (option)
  - Position output control by square root extraction of input signals

- Communication function
  - Communication type : RS-232C, RS-485
  - Communication system : Half duplex asynchronous system
  - Communication rate : 1200, 2400, 4800, 9600, 19200 bps
- General specifications
  - Data storage : Non-volatile memory
  - Operating ambient temperature/humidity range : -10~+50°C/90% RH or less (no dew condensation)
  - Storage temperature : -20~65°C
  - Supply voltage : 100~240V AC±10% 50/60Hz
  - Power consumption : 13VA (240V AC)
  - Conformity with standards Safety : IEC1010-1 and EN61010-1  
EMC : EN61326
  - Insulation resistance : Between input/output terminals and power terminal 500V DC 20MΩ or above  
Between power terminal and ground terminal 500V DC 20MΩ or above
  - Dielectric strength : Between input/output terminals and power terminal 2300V AC 1 minute  
Between power terminal and ground terminal 1500V AC 1 minute
  - Protective structure : Only front panel has dust-proof and drip-proof structure. (IP66 equivalent)
  - Material of case : PPO resin molding (equivalent to UL 94 V-1)
  - External dimensions : H96 × W96 × D111 (Panel depth: 100) mm
  - Mounting : Push-in panel (one-touch mount)
  - Panel thickness : 1~4 mm
  - Panel cutout : 92 × 92 mm
  - Weight : Approximately 460 g

The contents of this manual are subject to change without notice.

Temperature and Humidity Control Specialists

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